

4.9.4

DYED WATER TESTING PROCEDURE

Dyed water testing is a rainfall simulation technique used to more accurately locate and quantify inflow sources identified during smoke testing. The method is typically used on storm sewer sections, ditch sections, and stream sections. In addition to sources identified during smoke testing, locations with a high potential for inflow sources, such as sanitary and storm sewer crossings, may be checked using the dyed water technique. The test is limited to locations where large quantities of water and appropriate access are available.

EQUIPMENT

The following equipment is needed to conduct dyed water testing:

1. Fire hydrant wrench
2. 100' – 300' of fire hose
3. Fluorescent dye
4. Sewer pipe plug and/or sand bags
5. Mirror/flashlight
6. Pipe wrenches
7. Water meter (if required)
8. Weirs

The dye should be safe to handle, visible in low concentration, miscible in water, inert to the soil and the debris in the sewers, and biodegradable.

PRELIMINARY WORK

Prior to the dye test, a thorough review of all pertinent field data (smoke test, notes, etc.) should be performed. All areas to be dye tested should be selected and a sketch of available information relative to each test should be made showing sanitary sewer lines, storm sewer lines, ditches, water courses, streets and direction. Before completing the sketches, a field investigation of each dye test area should be made to:

1. Verify the relative position of sanitary sewers with the storm sewer or ditch to be dye flooded.
2. Determine plugging points, sewer size, and available access to storm sewers.

3. Locate fire hydrants or other water sources.
4. Determine the extent of flooding (i.e., depth of water in ditch, storm pipe depth).
5. Ensure feasibility for dye flood at each location and note any special problems, if any. The dye flooding sketches should then be updated based on the field investigations.
6. Policy on use of fire hydrant water should be checked with the appropriate city official prior to testing. If the City requires the water used to be recorded, obtain a water meter from the appropriate city official.

FIELD PROCEDURE

Before flooding the ditches and storm sewers, plug storm section securely, and measure the depth of flow in the sanitary sewer downstream of the test location. Dye should be introduced to the “storm” water flow early in the flooding to ensure adequate mixing. The time should be noted at the beginning of flooding and at the appearance of dye, if any, in the sanitary sewer. It is essential that sewer line(s) where dye appeared be accurately noted. If dye does not appear, wait for a period of at least one hour after filling the storm section and observe the sanitary sewer for appearance of dye. Quantification of inflow sources should be made by actual measurement of depth of flow and velocity before and after flooding. Where directly connected catch basins are dye flooded, and estimate of tributary area and type of surface drained (paved or non-paved) should be included on the form. Actual measurement of inflow may be taken by depth and velocity readings in the sanitary sewer or by the use of weirs where flow depths and velocities are too low to measure accurately. In large diameter sanitary sections flowing greater than 1/3 full, depth readings to determine inflow may not be feasible due to the accuracy required and inherent measurement errors. Also, unless a relatively large inflow source with a quick dye transference time is observed, depth measurements in the sanitary line for inflow estimates may be misleading because of diurnal variation in flow. For each positive dye test, lamping should be performed in an effort to pinpoint the defect and to determine whether or not television inspection will be required to locate the actual source of dye.

The attached Dyed Water Flooding Inspection Form should be completed for each dye test including all information concerning storm and sanitary sewer locations, flooding time, calculations of inflow rate, lamping data, water use, where dye was introduced, depth and velocity readings, and other pertinent data. Work should proceed in an upstream direction for the sanitary sewer system to avoid dye carryover from previous dye tests. All sanitary sections in which dye appeared should be recommended for TV inspection, if the actual defect can not be identified through lamping.

DYED WATER FLOODING INSPECTION FORM STANDARDS

Entry Number

Project No.: The project number should be clearly stated.

Project Name: The project name should be stated. Project initials or an abbreviated name may be acceptable. The form can be stamped with a project name stamp during office review.

By: The inspector numbers of the crew conducting the dye flooding should be entered.

Date: The date should be indicated.

- 1) Line Segment: The line segment on the map should be entered.
- 2) Street: Indicate the approximate location of the line segment with respect to house number, intersections, or other manholes.
- 3) Precipitation: As observed.
- 4) Ground: As observed.
- 5) Area Flooded with Dyed Water: Indicates the storm section which was flooded with dyed water.
- 6) Diameter of Sanitary Pipe: As measured to the nearest inch. Care should be taken not to measure the bell of the pipe.
- 7) Diameter of Storm Pipe (if any): If the storm section flooded is a storm sewer, the pipe should be measured to the nearest inch. Care should be taken not to measure the bell of the pipe. The number (if any) of the storm manhole on the map should be entered.

Depth of Sanitary Pipe: As measured from the manhole rim to the invert of the sanitary pipe to the nearest foot.

Depth of Storm Pipe: As measured from the manhole rim to the invert of the storm pipe to the nearest foot.

Difference: The difference as calculated from subtracting the depth of the storm pipe from the depth of the sanitary pipe.

- 8) Dyed Water Observed at Sanitary Manhole No.: Indicates sanitary manhole number where dyed water is actually observed. This is always the downstream manhole in the line segment. If dye is observed in a second line segment, another dye form should be filled out for the second line segment.
- 9) Storm Sewer or Ditch Crossing Over the Sanitary Sewer: Indicates the flooded storm section crosses over the sanitary sewer being tested.
- 10) Storm Sewer or Ditch Parallel to the Sanitary Sewer: Indicates the flooded storm section is parallel to the sanitary sewer being tested.
- 11) Building Laterals Passing Under Storm Sewer or Ditch: Indicates the flooded storm section is between the sanitary sewer being tested and buildings which have lateral connections to the sanitary sewer.
- 12) Septic Field not Properly Plugged: Indicates a septic field is leaking into the sanitary sewer being tested.
- 13) Sanitary Cleanout Located in Depressed Area or Ditch: Indicates a leaking cleanout is located in a depressed area or ditch. The depth of water above the cleanout shall be estimated to the nearest inch.
- 14) Leaking Cracks in Sanitary Manhole: Indicates dyed wastewater observed entering through the sanitary manhole wall or pipe seals. The number of the manhole in which dye is observed should also be recorded. This should always be a downstream manhole unless dye appears in a dead end manhole. Otherwise, another dye form should be filled out, with the leaking manhole as the downstream manhole.
- 15) Directly Connected Catch Basin or Storm Sewer: Indicates a catch basin or storm sewer is directly connected to the sanitary sewer being tested. When the catch basin enters the sanitary manhole or is observed by lamping, the line segment should not be recommended for television inspection. The tributary area of the area drained by the catch basin and surface type should be indicated on the form.
- 16) Leaking Pipe and/or Manhole Located Under: Indicates the type of surface at the location of the potential cross-connection. This information is used to estimate the construction cost of removing the cross-connection.

17) This Section Recommended for TV Inspection: If the dye test is positive and the defect can not be identified by observing the manhole or by lamping, the line segment should be recommended for television inspection.

Dye Observed: Record time when dye was observed in the sanitary sewer, depth of flow, and velocity of flow. Remaining boxes are for office use only.

Dye Flooding Started: Record time when dye flooding commences, depth of flow in the sanitary sewer, and the velocity of flow in the sanitary sewer, and the velocity of flow in the sanitary sewer. Remaining boxes are for office use only.

Number of Hoses Used: The number and/or length of hoses used for the dye flooding set up should be recorded. This information is used when the dye flooding set up is repeated during television inspection.

The Dyed Water Flooding Inspection Form is attached for reference.

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Dyed Water Flooding Inspection Form

Project No. RJN-_____ Project Name _____ By _____ Date ____/____/____

1. Line Segment (A1B2) A1B2C3D4E5F6 - (_____) - _____
2. Street _____
3. Precipitation: 1 ☐ None 2 ☐ Light Rain 3 ☐ Heavy Rain 4 ☐ Snow
4. Ground: 1 ☐ Dry 2 ☐ Wet 3 ☐ Standing Water
5. Area Flooded with Dyed Water: 1 ☐ Storm Sewer 2 ☐ Storm Ditch 3 ☐ Depressed Grass Area
4 ☐ Depressed Paved Area 5 ☐ Storm Sewer Manhole 6 ☐ Catch Basin 7 ☐ Septic Field
6. Diameter of Sanitary Pipe 99 IN.
7. Diameter of Storm Pipe (If Any) 999 IN. Storm Manhole No. (if any) A1B2
8. Dyed Water Observed At Sanitary Manhole No. (A1B2) A1B2C3D4E5F6: ☐ Yes ☐ No
9. Storm Sewer or Ditch Crossing Over the Sanitary Sewer: ☐ Yes ☐ No Rate 999 GPM
10. Storm Sewer or Ditch Parallel to the Sanitary Sewer: ☐ Yes ☐ No Rate 999 GPM
11. Building Laterals Passing Under Storm Sewer Or Ditch: ☐ Yes ☐ No Rate 999 GPM
12. Septic Field Not Properly Plugged: ☐ Yes ☐ No Rate 999 GPM
13. Leaking Cracks in Sanitary Manhole (A1B2) A1B2C3D4E5F6: ☐ Yes ☐ No Rate 999 GPM
14. Directly Connected Catch Basin or Storm Sewer: ☐ Yes ☐ No Rate 999 GPM
15. Main Line Defect: ☐ Yes ☐ No Rate 999 GPM
16. Leaking Pipe and/or Manhole Located Under:
☐ Paved Area ☐ Non-paved Area ☐ Remote Non-paved Area ☐ Tributary Area 99999 SF (Paved/Non-paved)
17. This Section Recommended for TV Inspection: ☐ Yes ☐ No

Comments:

	Time	Depth(ft.)	Velocity (fps)	d/D	a/A	Area (sf)	Flow (gpm)
Dyed Observed							
Flooding Started							

Sketch

Difference = 999 gpm

Number of Hoses Used:

Tank/Hydrant:

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